

## CLAIMS

What I claim is:

1. An evacuation apparatus for enabling a person to descend from an origin at a predetermined height in a multistory building to a lower supporting surface at a sufficiently slow speed to land injury-free, the apparatus comprising:
  - a housing;
  - a harness for securely affixing the housing to the person;
  - a cable within the housing, of predetermined length sufficient to reach from the origin to the lower supporting surface, the cable having a free end which includes a securing member for attaching the free end to a fixed anchorage proximate the origin; and
  - an energy-dissipating mechanism within the housing, driven by the payout of the cable from the housing as the person descends, having the characteristic that the slope of the rate of energy dissipated exceeds the slope of the rate of potential energy released as a function of the descent speed at their point of intersection, and the characteristic that the intersection occurs at the sufficiently slow descent speed without the person's control.
2. The apparatus as recited in claim 1 wherein the descent speed attained during the descent is less than four feet per second.
3. The apparatus as recited in claim 1 wherein the apparatus includes a rotatable member within the housing and the payout of the cable from the housing causes the rotatable member to rotate.

4. The apparatus as recited in claim 3 wherein the rotatable member is a spool that houses the cable.
5. The apparatus as recited in claim 3 wherein the energy dissipating mechanism is driven by the rotation of the rotatable member through a speed-increaser.
6. The apparatus as recited in claim 5 wherein the speed-increaser is comprised of an arrangement of gears.
7. The apparatus as recited in claim 5 wherein the speed-increaser is comprised of a belt and pulley arrangement.
8. The apparatus as recited in claim 1 wherein the energy dissipating mechanism comprises an air resistance fan with a plurality of vanes.
9. The apparatus as recited in claim 8 wherein the vanes of the fan are substantially semi-cylindrical in shape.
10. The apparatus as recited in claim 1 wherein the energy dissipating mechanism comprises a generator and resistance.
11. The apparatus as recited in claim 10 wherein the resistance comprises a plurality of resistors which are switch-selectable prior to the descent.
12. The apparatus as recited in claim 1 wherein the energy dissipating mechanism comprises an eddy current brake.
13. The apparatus as recited in claim 12 wherein the eddy current brake includes a stator and a rotor with a gap therebetween wherein the size of the gap between the stator and the rotor is adjustable prior to the descent.
14. The apparatus as recited in claim 4 further comprising a cable de-slacking mechanism within the housing.

15. The apparatus as recited in claim 14 wherein the cable de-slacking mechanism removes slack from the cable prior to the descent.
16. The apparatus as recited in claim 14 wherein the cable de-slacking mechanism removes slack from the cable prior to subsequent descents from other supporting surfaces located below the predetermined height.
17. The apparatus as recited in claim 14 wherein the cable de-slacking mechanism comprises a substantially constant-torque spring that rewinds the spool that houses the cable.
18. The apparatus as recited in claim 1 wherein the apparatus further comprises a cable force limiting mechanism to protect the cable from transient overloads.
19. The apparatus as recited in claim 3 wherein the apparatus further comprises a cable force limiting mechanism to protect the cable from transient overloads.
20. The apparatus as recited in claim 18 wherein the cable force limiting mechanism is at least one energy-absorbing web in-line with the cable.
21. The apparatus as recited in claim 19 wherein the cable force limiting mechanism is a torque limiting mechanism applied to the rotatable member.
22. The apparatus as recited in claim 18 wherein the cable force limiting mechanism is the reduced spring-constant of the played-out cable.
23. The apparatus as recited in claim 21 further comprising a thermal clutch that automatically decouples the energy dissipating mechanism when the ambient temperature goes above a preset temperature.
24. The apparatus as recited in claim 23 wherein the thermal clutch recouples the energy dissipating mechanism when the ambient temperature goes below the

preset temperature.

25. The apparatus as recited in claim 1 wherein the harness includes at least one of: straps, ropes, tethers, clips, buckles, snaps, ties, rings, Velcro, tensioners, bungees, bands, loops, and belts, that accommodate to the size of the person.
26. The apparatus as recited in claim 1 wherein the cable is capable of supporting at least two and a half times the maximum descending weight.
27. The apparatus as recited in claim 1 wherein the cable is a steel wire-rope.
28. The apparatus as recited in claim 1 wherein the cable is a high-strength polymer cable.
29. The apparatus as recited in claim 1 wherein the cable is made up of a composite of materials.
30. The apparatus as recited in claim 1 wherein the securing member is a carabiner.
31. The apparatus as recited in claim 30 wherein the fixed anchorage can accommodate a plurality of carabiners.
32. The apparatus as recited in claim 1 wherein the fixed anchorage is located proximate an egress opening of the building.
33. The apparatus as recited in claim 1 wherein the fixed anchorage is secured to a structural member of the building.
34. The apparatus as recited in claim 1 further including a protective helmet worn by the person.
35. The apparatus as recited in claim 1 further including an air filtration system.
36. The apparatus as recited in claim 35 wherein the air filtration system filters

out smoke and other combustion products for at least 30 minutes.

37. A method for enabling a person to descend from an origin at a predetermined height in a multistory building to a lower supporting surface at a sufficiently slow speed to land injury-free, using an evacuation apparatus comprising a housing that contains a cable that is long enough to reach from the origin to the lower supporting surface and an energy dissipating mechanism, the cable having a free end with a securing member for attaching to a fixed anchorage proximate the origin, and a harness, the method comprising the steps of:

using the harness to securely affixing the housing to the person;

attaching the free end of a cable to the fixed anchorage;

exiting the building at the origin of the descent; and

descending to the lower supporting surface at the sufficiently slow descent speed.

38. An evacuation apparatus for enabling a person to descend from an origin at a predetermined height in a multistory building to a lower supporting surface at a sufficiently slow speed to land injury-free, the apparatus comprising:

a housing means for containing a cable and a speed slowing means

a harness means for securely affixing the housing to the person;

a cable of predetermined length sufficient to reach from the origin to the

lower supporting surface, the cable having a free end which

includes a means for securing the free end to a fixed anchorage

proximate the origin; and

an energy-dissipating means driven by the payout of the cable from the housing means as the person descends, the energy-dissipating means having the characteristic that the slope of the rate of energy dissipated exceeds the slope of the rate of potential energy released as a function of the descent speed at their point of intersection, and the characteristic that the intersection occurs at the sufficiently slow descent speed without the person's control.

39. A mass evacuation system for rescuing a plurality of persons from origins at predetermined heights in a multistory building to a lower supporting surface, the system including a plurality of evacuation apparatuses, each enabling a person to descend at a sufficiently slow speed to land without injury to themselves or other persons, each rescue apparatus comprising:

a housing;

a harness for securely affixing the housing to the person;

a cable within the housing, of predetermined length sufficient to reach from the origin to the lower supporting surface, the cable having a free end which includes a securing member for attaching the free end to a fixed anchorage proximate the origin; and

an energy-dissipating mechanism within the housing, driven by the payout of the cable from the housing as the person descends, having the characteristic that the slope of the rate of energy dissipated exceeds the slope of the rate of potential energy released as a function of the descent speed at their point of intersection, and

the characteristic that the intersection occurs at the sufficiently slow descent speed without the person's control.

40. An evacuation apparatus for enabling a person to descend from an origin at a predetermined height in a multistory building to a lower supporting surface, the apparatus including a cable in combination with a cable-retracting mechanism to eliminate any slack in the cable, thereby reducing free-falls during initial and possible subsequent descents.
41. An evacuation apparatus for enabling a person to descend from an origin at a predetermined height in a multistory building to a lower supporting surface, the apparatus including a cable in combination with a mechanism to protect the cable during the descent from transient overloads beyond its capability, the mechanism comprising at least one of: an in-line energy-absorbing web, a torque-limiting mechanism, the reduced effective spring constant of the played-out cable.
42. An evacuation apparatus for enabling a person to descend from an origin at a predetermined height in a multistory building to a lower supporting surface, in combination with an air filtration system capable of filtering out smoke and other combustion products to enable the person to breathe safe air during the period before exiting the building.
43. An evacuation apparatus for enabling a person to descend from an origin at a predetermined height in a multistory building to a lower supporting surface, in combination with a device to protect against heat exposure injury, the device comprising at least one of: a deployable heat-deflecting shield, a

heat-deflecting body suit, a thermal mechanism to increase the descent rate of the apparatus through hot zones.

44. An evacuation apparatus for enabling a person to descend from an origin at a predetermined height in a multistory building to a lower supporting surface, in combination with a full-head protection helmet protecting against falling debris and incidental contact with obstacles during the descent.